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A NATIONAL PROGRAM FOR WATER POLLUTION CONTROL. CONSIDERATION OF SOME ELEMENTS IN ITS FORMULATION AND ADMINISTRATION

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A NATIONAL PROGRAM FOR WATER POLLUTION CONTROL. CONSIDERATION OF SOME ELEMENTS IN ITS FORMULATION AND ADMINISTRATION.*

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There has been an increasing appreciation by the people of this country of the necessity for a consistent reduction in the extent to which our surface waters are being degraded by contributions of domestic and industrial sewage. This attitude is finding more and more frequent expression in the actions of representative bodies of citizens such as that of the American Association for the Advancement of Science with more than 18,000 members and 141 associated societies and academies representing a total membership of more than 725,000 which at its recent meeting in Pittsburgh adopted the following resolution concerning the pollution of public waters:

"Whereas the degree of control of pollution of coastal and inland waters by domestic and industrial wastes, which is essential for public health and national welfare, has not yet been achieved and can not be without further development and coordination of Federal, state and local authority, Therefore, be it resolved that the American Association for the Advancement of Science, meeting at Pittsburgh, urgently recommends the adoption of legislation adequate to control pollution of public waters".

There are several outstanding causes for this growing demand for the sanitary protection of our water resources among which may be mentioned: (a) the necessity for conserving the quality of our sources

(*) Presented before meeting of New Jersey Sewage Works Association, Trenton, N. J., March 21-22, 1935.

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of public water supply, (b) increasing nuisance and damage suffered by riparian owners, (c) deterioration in recreational and aesthetic value of streams, lakes and coastal waters affecting a large percentage of our population, and (d) economic losses imposed upon the industrial and commercial uses of surface waters including those of fish and shell fish production. Each one of us, no doubt, could cite specific instances coming under his personal observation in which one or more of these objectionable conditions has forced upon him the conclusion that some adequate relief must sooner or later be provided.

The increasing urge, or even demand, for improvement in this situation can be relieved and counteracted permanently, only by the establishment and support of adequate control authority, comprehensive planning of water pollution abatement measures and reasonable but consistent enforcement of stream cleaning policies on a national scale. This is admittedly a far reaching activity but the exigencies of the case require broad corrective measures if these problems are to be solved conclusively and in the interest of the greatest good to the greatest number. The membership of sewage works organizations, such as this, is made up of the type of trained men upon whom a large part of the responsibility for carrying out such a program must be placed. We should be prepared to assume this responsibility not only in the execution of the plan but in the assumption of intelligent leadership during its formulation to insure that only reasonable and practicable procedures are incorporated. To stimulate thought and focus attention on these matters, is the object of this paper.

THE EXTENT OF THE WATER POLLUTION PROBLEM.

Before discussing remedial suggestions, some general observations concerning the extent and intensity of water pollution may be helpful. It is reasonable to suppose that urban population is, in general, a reasonable index of stream pollution by domestic sewage. As of 1930, there were 3165 incorporated places in the continental United States with a total of 68,955,000 population or 56 per cent of the entire population of the country. This urban population is not equally distributed over the entire United States, however. In the section north of the Ohio and Potomac and east of the Mississippi Rivers, comprising 14 per cent of the total area, are located 1635 or 51.7 per cent of the total number of towns, containing 65.4 per cent of the total urban population of the country. Moreover, in this same north-eastern section, the rural population, which presumably suffers some harmful effects resulting from urban and industrial pollution, averages 40.5 per square mile in comparison with 14.1 per square mile for the remainder of the country. Altogether, the combined urban and rural population in this area comprises 50.6 per cent of that of the continental United States. It is to be expected, therefore, that in general - while there are numerous exceptions - water pollution and damage suffered therefrom would be most intensive in this north-eastern division, a section where recreational facilities are highly developed as well.

The intensity of water pollution may be gaged in general terms by the amount of domestic sewage and industrial wastes contributed, making proper allowance for such proportion of these wastes as are treated before discharge to the receiving waters. For the country as a whole, comprehensive

data on sewered populations are non-existent. On the entire Ohio River watershed of some 203,000 square miles, a complete survey in 1914-1916 by the Public Health Service, revealed that 72.1 per cent of the total urban population was connected to sewers. A similar survey of the Illinois watershed in 1920-1922 showed that, exclusive of Chicago, 76 per cent of the urban population was served by sewers, while on the upper Mississippi River, exclusive of the Minneapolis-St. Paul Metropolitan District, this figure was found to be 68 per cent. Based on these data, an estimate of 75 per cent of the urban population connected to the sewers would appear reasonable and conservative.

The relative polluting effect of industrial wastes is even more difficult to estimate and will vary widely in different areas depending upon the nature of the dominant manufactured products. Considering organic pollution only, on the Ohio River watershed, our survey showed that the industrial wastes were equivalent to 124 per cent of that contributed by domestic sewage. On the Illinois River the population equivalent of industrial wastes was 85 per cent and on the upper Mississippi River 92 per cent. It would probably be fair to say that, generally, the organic pollution contributed by industry is about equal to that contributed by population.

Combining these two estimates would result in the conclusion that the total organic pollution load is equivalent to that of the domestic sewage of 1-1/2 times the total urban population of the country. This potential load of pollution would be reduced, however, in proportion to the extent of treatment effected before these wastes are discharged to the receiving waters. Again, the extent and efficiency of sewage treatment processes vary widely in different parts of the country.

It can be said safely that the volume of sewage being treated is increasing much more rapidly than is the population contributing sewage and also that the general, overall efficiency of sewage purification has improved. However, there are few reliable data available as to the proportion of the total raw sewage of this country that is being treated. Referring again to the Ohio River survey - at that time 11.8 per cent of the sewered population were discharging sewage through some form of treatment process. The Conference of State Sanitary Engineers Committee finds that in 33 states reporting, about 50 per cent of all sewered communities have some form of treatment for at least a part of their sewage. These treatment processes range from screening and sedimentation to oxidation and chlorination. On the other hand, at the time of our surveys (1920-1927) no sewage was being treated on the Illinois River watershed and only 8.3 per cent of the total on the Upper Mississippi. Taking into consideration the average efficiency of all treatment plants as a group, and considering that a relatively small percentage of industrial wastes are treated at all, it is likely that at present the potential organic sewage pollution load is not being reduced by treatment by more than 20 per cent at most. On this basis the equivalent of 1.2 times the urban population of the country or 82,700,000 persons contribute raw sewage directly to our surface waters. Applying this same estimate to the north-eastern portion of the United States, the waters of this area are receiving the equivalent of untreated sewage from 54 millions of people or nearly half the total population of the country.

This excessive pollution of our public waters affects directly the health, comfort and economy of human life in varying degree in all

sections of the country. Examples of such effects are: (1) unpalatable and hard public water supplies, (2) outbreaks of water-borne gastro-intestinal disorders and occasional epidemics of typhoid, (3) abandonment of many streams for recreational purposes, (4) widespread damage to fish life, including shell fish, (5) economic industrial loss through increased costs of water treatment for various trade purposes and stream power plants and reflected directly in limitation of the industrial development in such areas, (6) damage to agriculture. It is pertinent to note that such adverse effects create widespread problems that very frequently transcend local and state boundaries.

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PLANNING REMEDIAL MEASURES.

The broad extent of this problem of surface water pollution calls for carefully considered plans if adequate and effective relief measures are to be instituted. Such measures are of two general types. The first is concerned with the determination of proper technical procedures and treatment processes for dealing most economically with polluting materials to insure adequate stream protection but at the same time not to impose degrees of waste treatment in excess of those essential for effecting the desired results. The other type of planning has to do with the creation, definition of authority and methods for maintenance of the regulatory body or bodies necessary to stimulate and insure co-operative and efficient functioning of federal, regional, state and local government in a permanent program for improving and then maintaining the sanitary quality of our public waters.

Determination of essential relief measures for excessively polluted waters and the selection of economical processes for the treatment of pollutional materials are primarily technical problems for the

solution of which knowledge obtained through continuing research and experience are required. Such factors as the pollution load and its measurement, the natural recovery powers of polluted waters in motion or at rest, the conditions that influence these powers, the nature of use to be made of the waters of the receiving streams, are all points, among others, upon which definite information must be available and appraised for each particular case, if maximum return is to be obtained in situations where corrective measures are to be applied. This appraisal is likewise necessary for the selection of proper processes for the treatment of sewage and industrial wastes best fitted to local conditions. All of these factors obviously play an important role in the choice and in the application of plans to every case where stream improvement is to be undertaken. It is just as important not to over-treat or over-correct pollutional conditions, as it is to provide adequate treatment. This balance can only be attained by careful, objective planning, the organization and maintenance of which activity is one of the prime requisites for a successful program of stream cleaning.

In general - and there are few exceptions - it must be admitted that comprehensive and equitable control machinery has not been placed in operation in this country for relief of stream pollution on any nation-wide or even watershed scale. Such advances as have been made, generally have been of a local character. As a result, a change in viewpoint has developed that is insisting that some definite and inclusive action be taken by the Federal Government to bring about uniform improvement in the sanitary condition of our public waters. These demands are of one of two general types: One is that the Federal Government be granted broad, inclusive and mandatory powers to take

entire charge of all stream cleaning measures and be provided with sufficient funds to effect rapid relief wherever installation of such corrective procedures are indicated. The other general type of plan proposed is that the central government be authorized to assume directional responsibility for the development and execution of surface water sanitation procedures, working through and in co-operation with regional, state and other governmental agencies. As between these two suggested policies there is some conflicting opinion concerning the advantages of each.

The Community of Interest in Stream Sanitation.

There is a community of interest in the conservation of the quality of our public waters, and consideration of the extent of such interest should be helpful in arriving at some conclusions as to the most effective policy that will insure this conservation. These interests may be roughly grouped as local, state and federal. The local interest is more direct and confined to specific situations. It is concerned most generally with such particular problems as protection from excessive pollution of the source of the public or domestic water supply, the avoidance of local nuisance with resulting decline in real estate values and the train of other objectionable conditions that localized stream pollution entails, and the preservation of recreational facilities which clean waters provide. The state interest is more inclusive and is concerned not only with the individual municipal problems, but with the preservation of the sanitary quality of intrastate streams and lakes as units. The state desires to conserve its internal water resources for all its people including use for public water supply, industry and recreation, with particular emphasis on avoiding those objection-

able features which affect the public health. The federal interest is still more comprehensive and from the broader viewpoint of the welfare of all its citizens. In this group would fall among others, (1) preservation of the sanitary condition of interstate and navigable streams and lakes as well as of coastal waters and international and boundary waters, (2) the control of interstate spread of water-borne disease through such channels as unsafe drinking water and interstate exchange of improperly protected food and shell fish, (3) the conservation of surface waters for navigation and for prevention of flood damage on interstate watersheds. While these separate interests are necessarily overlapping in some details and are not always sharply defined, they do nevertheless, suggest a reasonable division of control responsibility that could be assumed for the solution of this water pollution problem.

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The Allotment of Governmental Regulatory Power.

Bearing in mind the various interests concerned in water sanitation as enumerated above, logical, successive divisions of territory for administrative authority and control purposes would seem to be: (1) Municipal or metropolitan areas, (2) States, (3) Regional or interstate watersheds, and (4) National. The first two of these groups have been and are more or less active in the correction of the water pollution problems with which they are immediately confronted. The principal defect has been, perhaps, the lack of comprehensive planning of control procedures and the little stimulation and support contributed by the central government, in the establishment of definite objectives and practical, economical methods for attaining them. To supply this deficiency it would seem wise, therefore, not to discard all local and state organiza-

tions which have been functioning with more or less success, but to coordinate them as working parts in a more comprehensive and far reaching arrangement in which they can be stimulated and supported in their particular spheres of action. For successive, superimposed steps in such a plan the watershed area authority and some suitable designated agency of the Federal Government appear advisable.

A regional or watershed administrative authority would seem to be essential for integration of policies and procedures where the correction of pollutional conditions of the public waters common to more than one state is undertaken. Only by some such device can the conflicting views and interests of individual states be composed and adjusted. Such an authority has not been developed or operated in this country for the sanitary protection of surface waters. Some forward steps are in progress in this direction notably on the Ohio River and Great Lakes watersheds, mostly in the nature of voluntary joint action by individual state government departments. We can learn much concerning the usefulness, organization and operation of such river boards from the experiences of England and Germany, where, in heavily industrialized and populated areas, they have offered the only practicable solution for intolerable conditions of excessive pollution of entire river systems.

In the same way, the organization and prosecution of a nation-wide program would seem to require the direction, stimulation and coordination of some authorized federal government agency which could function in these capacities as well as in that of the active representative of the larger federal interest as a whole. One existing difficulty of the individual state authorities has been the threat of organized industries to withdraw from a state where the fair enforcement of anti-

stream pollution regulations is attempted. It is a fair question, indeed, as to whether industry has ever assumed the relative degree of responsibility for objectionable condition of stream pollution which its contribution of pollutional wastes require. If reasonable regulations were uniformly in force throughout the country, real obstacles of this nature would be largely eliminated. For the uniform enforcement and efficient conduct of any country-wide activity of this kind, the necessity for some central federal authority would seem to require no extended defense.

The extent and limitations of administrative and regulatory powers to be assigned to each of these four successive classes of governmental authorities requires most careful study. Obviously, such powers must be adjustable to local and regional conditions and to that extent quite flexible. In a general way they should conform to the particular functions of the class to which they apply and at the same time permit, to the subordinate units, the utmost freedom of action consistent with the objectives of the larger program of sanitary protection of public waters. The decisions, actions and policies of these subordinate groups would of necessity have to be (for purposes of proper administration and coordination) subject to the review and approval of their ranking authority. Some observations concerning the distribution of these powers and responsibilities might not be out of place.

Responsibilities of Metropolitan Areas or Community Population Groups. From these groups as a rule originate the major volumes of concentrated, polluting wastes, both domestic and industrial. Upon these groups, therefore, would appear to rest the prime responsibility of applying to their wastes direct and adequate corrective measures previous

to discharging them to receiving waters, the adequacy of such treatment to be determined by the higher state or watershed planning authority. The detailed design, construction and operation of their sewage treatment plants would, therefore, be assigned to the individual communities, always subject to certification by the central authority either state or regional as to the need as well as to the sufficiency of the methods proposed. This procedure is practically now in effect in many states and has well demonstrated its usefulness.

Functions of States. The duties and powers of state authorities require clear definition in that they are of a more or less dual nature. States should be responsible for the proper functioning of the direct treatment procedures of cities, metropolitan centers and industries, with mandatory powers to require enforcement of their edicts concerning pollution abatement. At the same time the state is the logical unit to develop comprehensive detailed plans for the protection of intrastate waters and sources of public water supplies within its borders. To carry on these functions adequately, continued observations and inspections of sewage treatment plants and receiving waters would be necessary, together with provision for research study of specific local problems as they arise. These functions too, are now assumed and are in operation by the health departments, water commissions or similar authorities in many states. However, these state authorities in turn should be so constituted that coordination and cooperation with the regional and federal organizations is assured.

Duties of Regional or Interstate Watershed Boards. These regional groups, independent of state boundaries, are believed to be

essential for the prosecution of stream cleaning programs comprising large interstate areas or coastal regions. They must obviously function in close cooperation with state authorities but should be vested with adequate powers to enforce their decrees uniformly as in their judgment is essential for the sanitation of river systems and coastal waters as comprehensive units. They would, therefore, constitute the administrative agencies for stream cleaning activities in watershed areas within their respective jurisdiction. Such Board would of necessity be responsible for the development and prosecution of uniform, comprehensive plans for the improvement of our larger river systems as a whole, working through and requiring of the individual states, conformity in programs to bring about, most economically, these results.

The Central or Federal Government Agency. To head these regional, state and metropolitan authorities, a central authority is essential. The lack of such federal agency, clothed with adequate administrative and enforcement powers, is responsible primarily for the slow, unbalanced progress that is now being made in stream pollution control in this country. There are various functions that would naturally fall under the jurisdiction of this body.

The integration of the general policy of water conservation in the various regions of the country is most necessary. The interstate boards should be directly responsible to the central authority for the conduct and prosecution of their programs of river systems improvement as well as for the general policies which they adopt in effecting such improvements. Standards of water quality in streams, lakes and coastal areas need to be formulated and harmonized, equable protection of sources of drinking water supplies assured and determination made of the areas

where corrective measures are most essential. Coordination with other federal and state governmental agencies dealing with various phases of our water resources is also highly desirable. The improvement of navigation, the creation of water power by impounding reservoirs and lakes, the construction of comprehensive flood control projects and the extensive work of soil erosion prevention are only a few of the activities now under way on a national scale that vitally affect any stream pollution preventive measures that may be undertaken. The constituted federal agency should have ample powers to coordinate these various activities to the end that conflicts in aims and accomplishments in the improvement of our public waters be avoided to the largest possible extent.

A central federal authority would seem desireble for the continued stimulation of state and regional authorities to effective action. Such stimulation would doubtless assume various forms, including those of financial and technical assistance, advisory and consultative service and where necessary, compulsory and enforcement action. Doubtless the quickest and most immediately effective stimulus to regional or local authorities would be financial grants of federal funds. The extent, if any, of such assistance and the manner of its application is a subject not within the province of this discussion, but if such aid is made available by the Federal Government, it would seem that a competent, well informed central authority should be charged with its administration and distribution. Technical and legal assistance in organizing and conducting the activities of regional, state and municipal authorities dealing with water pollution problems would likewise stimulate these bodies in many instances. State and municipal officials are

frequently assigned such a multiplicity of duties that with the inadequate personnel provided, consistent progress on any specific activity is most difficult, and trained technical staffs can be built up only very slowly. Advisory service too is frequently most helpful to such authorities when special and unusual problems arise. There is need also, for this federal agency to be clothed with definite and positive compulsory powers in the small but nevertheless existing percentage of instances where all other measures fail to bring about cooperation on the part of divisional groups. Needless to say, such powers must always be judiciously employed although their existence is generally the only insurance against complete collapse of any governmental authority.

The federal or central body should also have the responsibility of arbitrating differences in objectives and viewpoints of state and interstate agencies and of disagreements that may arise among them. In the administration of extensive programs affecting the interests of many individuals, municipalities and industries, such differences are to be expected. Fair and equitable settlement of such disputes through arbitration provided by the central authority rather than by extended court procedures should promote the program.

It is also highly essential to provide for a continuing technical group, preferably in the central authority, where intensive research study may be devoted to the solution of the broad problems in water conservation certain to be encountered by the regional, state and metropolitan authorities. Such studies could be undertaken best by the central body because of the freedom from limitations imposed by state boundaries and because by such an arrangement considerable

duplication and repetition might be avoided. The facilities and findings of such a research organization should be made available to regional and state groups for the complete investigation of their technical and administrative problems. Such studies would necessarily cover a wide range of subjects and should be so directed as to render efficient service to its clientele. Among many other problems, it would doubtless be found advisable to investigate, (1) improved methods for the treatment and disposal of sewage and industrial wastes, (2) the efficiency of various water purification processes, (3) the practicability of establishing reasonable standards of purity for public water supplies, sewage treatment plant effluents, streams and lakes, bathing beach and bathing pool waters and waters in which edible shell fish are grown, (4) the natural laws of self purification of streams and the extent to which such natural agencies may be depended upon to effect recovery of polluted waters, and (5) the affect upon the public health of polluted water in all its forms as it comes in contact with the human organism. The federal authority would be the logical agency also for the continued collection and dissemination of factual data of value to the watershed, state and municipal agencies concerned with water pollution control. Such information, if authoritative, up-to-date and presented in suitable form would be most helpful and even essential to efficient administration. It would include such matters as technical and administrative practices and procedures; statistics of population distribution, industrial development and occurrence of waterborne disease; and digests of laws and legal decisions relating to the broad problems of water conservation.

These among others are some of the activities that must

necessarily devolve upon a central authoritative body created for the specific purpose, if consistent progress is to be made on a national scale in the protection of our water resources from harmful pollution.

CONCLUSION.

The almost universal degradation of our surface waters by polluting substances contributed by population groups and by industry has brought about a general appreciation that comprehensive corrective measures must be put into effect if our streams, lakes and coastal waters are to be of maximum use. Such measures involve the creation and maintenance of governmental authorities that will be required to function over the greater part of the area of our country. Suggestions for the formation and assignment of functions of such an organization are based upon the principle of employing so far as possible the existing machinery of states and of metropolitan areas now in operation, stimulating them where necessary and coordinating them under larger units in order to fit into the broader program of watersheds and river systems control as a whole. Directing these regional organizations, which are largely concerned with administrative procedures, a central, federal agency is proposed to advance the entire movement on a country-wide basis.

There are many financial and legal angles that must be taken into consideration in the creation and development of such a nation-wide program and which are not discussed here. Their consideration is most essential, however, to the successful functioning of any coordinated authority such as that herein proposed.

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These suggestions should not be considered as a final arbitrary plan of organization for control of water pollution. They are suggestions only, designed to indicate some of the factors that need to be considered in the formation and operation of a comprehensive country-wide program of water sanitation. If they arouse your interest in some of the many phases of water conservation sufficiently to induce you to render helpful service in the creation and development of efficient control machinery, the object of this paper will have been fully achieved.